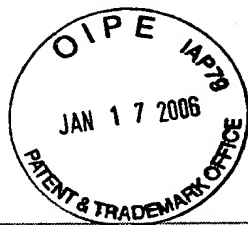


Medical imaging



From Wikipedia, the free encyclopedia.
(Redirected from Medical Imaging)



It has been suggested that this article or section be merged into *Radiology*.
(Discuss)

Medical imaging is the process by which physicians evaluate an area of the subject's body that is not externally visible. Medical imaging may be clinically motivated, seeking to diagnose and examine disease in specific human patients (*see* pathology). Alternatively, it may be used by researchers in order to understand processes in living organisms. Many of the techniques developed for medical imaging also have scientific and industrial applications.

Medical imaging often involves the solution of mathematical inverse problems. This means that cause (the properties of living tissue) is inferred from effect (the observed signal). In the case of ultrasonography the probe consists of ultrasonic pressure waves and echoes inside the tissue show the internal structure. In the case of radiography, the probe is X-ray radiation which is absorbed at different rates in different tissue types such as bone, muscle and fat.



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Origins

In its most primitive form, imaging can refer to the physician simply feeling an area of the body in order to visualize the condition of internal organs. This was used historically to diagnose aortic aneurysms, fractures, enlarged internal organs, and many other conditions. It remains an important step today in making initial assessments of potential problems, although additional steps are often used to confirm a diagnosis. The primary drawbacks of this approach are that the interpretation may be quite subjective and that recording the 'image' is difficult.

Modern imaging technology

http://en.wikipedia.org/wiki/Medical_Imaging

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Radiographs

Main article: Radiography

Radiographs, more commonly known as x-rays, are often used to determine the type and extent of a fracture as well as for detecting pathological changes in the lungs. With the use of radio-opaque contrast media, such as barium, they can also be used to visualize the structure of the stomach and intestines - this can help diagnose ulcers or certain types of colon cancer.

Fluoroscopy

Main article: Fluoroscopy

Fluoroscopy produces real-time images of internal structures of the body in a similar fashion to Radiography, but employs a constant input of x rays. It is often used in image-guided procedures when constant feedback during a procedure is required.

Computed tomography

Main article: Computed tomography

A CT scan, also known as a CAT scan (Computed Axial Tomography scan), traditionally produces a 2D image of the structures in a thin section of the body. It uses ionizing radiation such as X-rays and thus repeated scans should be avoided.

Magnetic resonance imaging

Main article: Magnetic resonance imaging

An MRI uses powerful magnets to excite hydrogen nuclei in water molecules in human tissue, producing a detectable signal. Like a CT scan, an MRI traditionally creates a 2D image of a thin "slice" of the body. As an MRI does not use ionizing radiation, it is the preferred imaging method for children and pregnant women.

Ultrasound

Main article: Medical ultrasonography

Medical ultrasonography uses high frequency sound waves of between 2.0 to 10.0 megahertz that are reflected by tissue to varying degrees to produce a 2D image, traditionally on a TV monitor. This is often used to visualize the fetus in pregnant women. Other important uses include imaging the abdominal organs, heart, male genitalia and the veins of the leg. While it may provide less anatomical information than techniques such as CT or MRI, it has several advantages which make it ideal as a first line test in numerous situations, in particular that it studies the function of moving structures in real-time. It is also very safe to use, as the patient is not exposed to radiation and the ultrasound does not appear to cause any adverse effects. It is also relatively cheap and quick to perform. Ultrasound scanners can be taken to critically ill patients in intensive care units saving the danger of moving the patient to the radiology department. The real time moving image obtained can be used to guide drainage and biopsy procedures. Doppler capabilities on modern scanners allow the blood flow in arteries and veins to be assessed.

Creation of three-dimensional images

Recently, techniques have been developed to enable CT, MRI and Ultrasound scanning software to produce 3D images for the physician. Traditionally CT and MRI scans produced 2D static output on film. To produce 3D images, many scans are made, then combined by computers to produce a 3D model, which can then be manipulated by the physician. 3D ultrasounds are produced using a somewhat similar technique.

With the ability to visualize important structures in great detail, 3D visualization methods are a valuable resource for the diagnosis and surgical treatment of many pathologies. It was a key resource (and also the cause of failure) for the famous, but ultimately unsuccessful attempt by Singaporean surgeons to separate Iranian twins Ladan and Laleh Bijani in 2003. The 3D equipment was used previously for similar operations with great success.

Other imaging techniques

Other proposed or developed medical imaging techniques (often termed *modalities*) include:

- diffuse optical tomography
- elastography
- electrical impedance tomography
- nuclear medicine
- optoacoustic imaging
- ophthalmology
 - A-scan
 - B-scan
 - corneal topography
 - Heidelberg retinal tomography
 - Optical coherence tomography
 - scanning laser ophthalmoscopy
- positron emission tomography

Some of these techniques are still at a research stage and not yet used in clinical routines.

Non-diagnostic imaging

Neuroimaging has also been used in experimental circumstances to allow people (especially disabled persons) to control outside devices, acting as a direct mind-computer interface.

External links

- Imaging-Centers.com (<http://www.imaging-centers.com/>) is the first searchable directory of medical imaging centers across the United States.

See also

- Medical test
- Medical examination
- PACS
- Tomogram
- Digital Imaging and Communications in Medicine (image format)
- Biomedical informatics

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